



Food & Beverage Series

SIMULTANEOUS MEASUREMENT OF GLUCOSE
AND SUCROSE IN FROZEN ICE CREAM BARS

Application Note 209LS
YSI Life Sciences



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INTRODUCTION

Dextrose (D-glucose) and sucrose concentrations in complex matrices such as ice cream bars can be measured directly and quickly using the YSI 2900 Series Biochemistry Analyzer. YSI's unique enzyme technology provides for rapid glucose and sucrose measurements. Measurements are virtually unaffected by color, turbidity, density, pH, or the presence of reducing substances.

When a 2900 Series Biochemistry Analyzer is equipped with a glucose and a sucrose membrane, simultaneous measurement of both analytes is possible. Because glucose interferes with sucrose analysis, it is necessary to follow this protocol when analyzing for sucrose in the presence of glucose.

When a sample is injected into the sample chamber, the sucrose diffuses to the sucrose membrane, which contains invertase, mutarotase, and glucose oxidase. The sucrose is hydrolyzed to α -D-glucose and fructose. The mutarotase allows for the quick equilibrium of glucose between its α and β forms. In the presence of glucose oxidase, the β -D-glucose (glucose) is oxidized to hydrogen peroxide and D-glucono- δ -lactone. The hydrogen peroxide is detected amperometrically at the platinum electrode surface. The glucose in the sample diffuses to both the glucose and sucrose membranes, which contain glucose oxidase, and is oxidized as well. Subtracting the response of the glucose membrane from the response of the sucrose membrane yields the response due to sucrose alone. The glucose response is taken directly from the glucose membrane. The algorithm in the instrument software calculates the net concentrations. For more information on this system, refer to the Operations Manual.

I. MATERIALS & SETUP

- YSI 2900 Series Biochemistry Analyzer - equipped with a 2703 Sucrose Membrane, a 2365 Glucose Membrane and 2357 Buffer.
- Glucose (2.50 g/L, 25.00 g/L) and Sucrose (5.00 g/L, 25.0 g/L) standard solutions.
- Buffer Diluent (40 g/L NaH_2PO_4 , 10g/L Na_2HPO_4 in reagent water).

- Connect the 2900 Series instrument to a suitable power source.
- Perform the instrument and membrane daily checks described in the Operations Manual.
- Volumetric glassware (Class A recommended).
- The following instrument setup is recommended:
Sample Size 10 μL

Probe A Parameters

Chemistry Unit	Glucose g/L
Calibrator	2.50
End Point	30 Sec

Probe B Parameters

Chemistry Unit	Sucrose g/L
Calibrator	5.00 g/L
End Point	30 Sec

Autocal Parameters

Temperature	1°C
Time	30 Min
Sample	5 Sam
Cal Shift	2%

II. METHOD

- Separate the chocolate coating from the ice cream.
- Transfer the chocolate coating to a container that is water resistant and can be closed, such as a bottle or a plastic bag.
- Immerse the container into a beaker of hot water (55-65°C) making sure no water enters the container. Allow the sample to melt stirring occasionally to keep the sample homogeneous.
- Transfer about 5 grams (record exact weight) of the chocolate coating to a 100 mL volumetric flask, using buffer diluent to rinse and dilute. Fill the flask to the mark with buffer and mix. Allow the solution to equilibrate for about 20 minutes.

- Transfer the ice cream (without coating) into a water
- continued*

resistant container and immerse in hot water until the sample is melted. Stir occasionally to keep the sample homogeneous.

- F. Transfer about 10 grams (record exact weight) of the ice cream sample to a 100 mL volumetric flask using buffer diluent to rinse and dilute. Fill the flask to the mark with buffer and mix. Allow the solution to equilibrate for about 20 minutes.
- G. Calibrate the 2900 Series instrument with 2.50 g/L glucose and 5.00 g/L sucrose standard solutions.
- H. Check the linearity of the membrane at least once a day by injection of glucose (25.00 g/L) and sucrose (25.0 g/L) linearity check solutions. Refer to the Operations Manual for specifications.
- I. Shake or stir the sample prepared in D, to keep the sample homogeneous. Assay the sample prepared in D, by aspiration into the 2900 Series instrument. Then assay the sample prepared in F by aspiration into the 2900 Series.*

* The linear range of the system is 0 to 25.0 g/L for both glucose and sucrose. The combined concentration of glucose + sucrose cannot exceed 25 g/L. If the sum of the values reported exceeds this, further dilution of the sample is required. If the glucose concentration exceeds the sucrose concentration accuracy and precision may be compromised due to the software algorithm that subtracts glucose from sucrose. To avoid compromising accuracy refer to Application Note 204LS.

III. CALCULATIONS

To calculate % glucose and sucrose, multiply the values reported by the appropriate dilution factor.

Example: 10.10 grams of ice cream were diluted to 100 mL in a Class A volumetric flask. When assayed, the values reported were 0.545 g/L glucose and 9.93 g/L sucrose.

% Glucose: 0.545 g/L x 0.100L /10.10 g	= 0.0054 gram glucose/gram ice cream = 0.54% (w/w)
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% Sucrose: 9.93 g/L x 0.100L /10.10 g	= 0.0983 gram glucose/gram ice cream = 9.83% (w/w)
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Example: 5.01 grams of chocolate coating were diluted to 100 mL in a class A volumetric flask. When assayed, the values reported were 0.118 g/L glucose and 8.73 g/L sucrose.

% Glucose: 0.118 g/L x 0.100L /5.01 g	= 0.0024 gram glucose/gram coating = 0.24% (w/w)
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% Sucrose: 8.73 g/L x 0.100L /5.01 g	= 0.1743 gram glucose/gram coating = 17.4% (w/w)
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ORDERING INFORMATION

YSI Part Numbers:

- 2900 Biochemistry Analyzer
- 2365 Glucose Membrane Kit
- 2776 Glucose Standard Solution (2.50 g/L)
- 2777 Glucose Standard Solution (25.00 g/L)
- 2703 Sucrose Membrane Kit
- 2780 Sucrose Standard Solution (5.00 g/L)
- 2778 Sucrose Standard Solution (25.0 g/L)
- 2357 Buffer Kit
- 2363 Potassium Ferrocyanide Test Solution
- 2392 NaCl Solution (for membrane installation)

For further information, please contact:

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